Fish Assemblage Surveys of Rondeau Bay, Ontario: 2004-2005

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ABSTRACT

Fisheries and Oceans Canada and the Ontario Ministry of Natural Resources conducted a survey of the fish communities in Rondeau Bay in 2004 and 2005. The objectives of the 2004 survey were: 1) to conduct a comprehensive fish community survey of Rondeau Bay utilizing a systematic approach consisting of fyke netting and boat electrofishing sampling methods; 2) to evaluate gear efficiency both within, and between, habitat types; and, 3) to evaluate the current status and distribution of fish species at risk within littoral habitats of Rondeau Bay. Sampling in 2005 was conducted to acquire current data on the fish assemblages present in the backwater channels and intermittently flooded habitats of the wetland, as these had not been sampled intensively in recent years. Special emphasis was placed on detecting species at risk.

In 2004, boat electrofishing was more effective than fyke netting at detecting species and catching fishes, regardless of habitat type. Boat electrofishing and fyke net sites along the west shore of the bay detected more species compared to boat electrofishing and fyke net sites along the east shore. In 2005, sites sampled using seine nets captured more fishes and detected more species than sites sampled with fyke nets. One species at risk, spotted gar (*Lepisosteus oculatus*), was detected during the 2004 survey, while two were detected in 2005: spotted gar and warmouth (*Lepomis gulosus*).

RÉSUMÉ

En 2004 et en 2005, Pêches et Océans Canada et le ministère des Richesses naturelles de l'Ontario ont mené une étude sur les communautés de poissons à la baie Rondeau. L'étude de 2004 visait à : 1) mener une étude approfondie sur la communauté de poissons de la baie Rondeau en utilisant une approche systématique consistant en des méthodes d'échantillonnage au moyen de verveux et pêche électrique en bateau; 2) évaluer l'efficacité du matériel à l'intérieur et entre les types d'habitat; et, 3) évaluer l'état actuel et la répartition des espèces de poissons en péril à l'intérieur des habitats littoraux de la baie Rondeau. L'échantillonnage de 2005 a été mené pour acquérir des données actuelles sur les assemblages de poissons présents dans les eaux dormantes et les habitats inondés par intermittence des terres humides, puisque ceux-ci n'avaient pas été échantillonnés de manière intensive au cours des dernières années. L'accent a été accordé sur le dépistage des espèces en péril.

En 2004, la pêche électrique en bateau était plus efficace que les verveux pour déceler les espèces et capturer les poissons, sans égard au type d'habitat. La pêche électrique en bateau et les sites de verveux le long de la rive ouest de la baie ont permis de déceler davantage d'espèces comparativement à la pêche électrique en bateau le long de la rive est. En 2005, les sites d'échantillonnage utilisant des sennes ont capturé davantage de poissons et ont décelé davantage d'espèces que les sites d'échantillonnage utilisant les verveux. Une espèce en péril, le lépisosté tacheté (*Lepisosteus oculatus*), a été décelée au cours de l'étude de 2004, alors que deux ont été décelées en 2005 : le lépisosté tacheté et le crapet sac-à-lait (*Lepomis gulosus*).

1.0 INTRODUCTION

Rondeau Bay is located on the north shore of Lake Erie, approximately 130 km west of Long Point and 65 km east of Point Pelee. Fisheries and Ocean Canada (DFO), and the Ontario Ministry of Natural Resources (OMNR) conducted a fish survey of the bay in 2004. The objectives of the survey were threefold: 1. to conduct a comprehensive fish community survey of Rondeau Bay utilizing a systematic approach consisting of fyke netting and boat electrofishing sampling methods; 2. to evaluate gear efficiency both within, and between, habitat types; and, 3. to evaluate the current status and distribution of fish species at risk within littoral habitats of Rondeau Bay.

In 2005, DFO returned to Rondeau Bay to intensively sample the inner coastal wetland along the eastern shore of the bay within Rondeau Provincial Park, in cooperation with OMNR. The purpose of the 2005 sampling was to acquire current data on the fish assemblages present in the backwater channels and intermittently flooded habitats of the wetland, as these had not been sampled intensively in recent years. Special emphasis was placed on detecting species at risk.

2.0 METHODS

2.1 SITE SELECTION

2.1.1 2004 Sampling

Two different ecological areas are found within Rondeau Bay. The east shore consists of wetlands created by a barrier beach system and is within the boundaries of Rondeau Provincial Park. The west shore of the bay is heavily farmed and numerous agricultural drains and creeks line the shoreline; the water is generally turbid, and there are fewer aquatic macrophytes. Original sites consisted of 16 standardized transects, approximately 300 m long, spaced equally around the perimeter of the bay. Eight sites were located on the west shore and the other eight were to be located along the east shore (Figure 1, Appendix 1). The 16 sites were to be sampled using two gear types, one passive (fyke nets) and one active (boat electrofishing); however, only seven sites were sampled along the east shore with the boat electrofishing unit due to shallow water at one site. Also, only six sites were sampled along the east shore using fyke nets. Boat electrofishing took place in June and fyke net sampling occurred in July and August. For simplicity, each site was numbered one through 15 for this report (Appendix 1).

2.1.2 2005 Sampling

In 2005, DFO conducted surveys in May, July and August, along the east shore of Rondeau Bay, within the wetlands created by the barrier beach system. A total of 34 sites were sampled in, and around, the wetlands of Rondeau Provincial Park (Figure 2, Appendix 2). Sixteen of these sites were sampled using both active (seine nets) and passive (fyke nets) gear types; eight sites were sampled using only fyke nets; and, 10 sites were sampled using only seine nets. Sites sampled in May were to be re-sampled in July; however, water levels in July had dropped enough that reaching the previously sampled sites was impossible. Sites 1-27 were originally to be spaced approximately 500 m apart but the complex shoreline of the inner wetlands, as well as difficulties with accessibility, made this essentially impossible. Sites ended up being selected based on accessibility and habitat features.

For simplicity, each site was numbered one through 34 for this report (Appendix 2).

2.2 SAMPLING GEAR – 2004

2.2.1 Boat Electrofishing

DFO conducted the electrofishing portion of the survey using a 6 m Model SR-20 Smith-Root electrofishing boat equipped with a Model 7.5 kW Smith-Root generator, 7.5 GPP control box, three kick plates and dual foot pedals. Each transect was sampled twice; at the end of each transect the power was shut down, the boat was turned around, and sampling continued along each transect until the start was reached again. A standard power output of 3200-3500 watts was maintained along the entire transect. Sampling data recorded at each site included capture method, sampling effort, electrofishing settings and a description of the sampling equipment. Two netters retrieved stunned fishes as they appeared, and all fishes were transferred from the river into a live-well within the boat. Species were identified, counted and released. Minimum and maximum total lengths were recorded for all species captured. Two individuals of each species were kept for lab verification.

2.2.2 Fyke Nets

Fyke netting was performed by OMNR, approximately one month after boat electrofishing occurred. Two 1.2 m fyke nets, with 6.35 mm mesh, were set at each transect, one at each end of the transect. The nets were set, left overnight and fished the following day (approximately 24 h sets). Species were identified, counted and

released. Minimum and maximum total lengths were recorded for each species. Two individuals of each species were kept for lab verification.

2.3 SAMPLING GEAR - 2005

Sixteen sites (1-4, 6-9, 12-15 and 24-27) located within the wetlands of Rondeau Provincial Park, were sampled using two gear types: a 9 m bag seine with 6.35 mm mesh, and a 1.2 m fyke net with 6.35 mm mesh. Seining was carried out before fyke nets were set. Three seine hauls were performed at each site except sites 12 and 24-27, which were seined twice each. Fyke nets were set, left overnight, and fished the following day (approximately 24 h sets). Sites 5, 10 and 11 were sampled with the 9 m bag seine with 6.35 mm mesh. Each site was seined three times. Sites 16-23 were sampled with a 1.2 m fyke net with 6.35 mm mesh. Fyke nets were left to soak for approximately 24 h. Sites 28-34 located just outside the wetlands, on sandy flats, were sampled with a 15 m boat seine. Each site was seined once.

2.4 SPECIES AT RISK

Discrete individual total length measurements and digital photos were taken of all species at risk caught during both 2004 and 2005 sampling. Any *Ictiobus* sp. or spotted gar (*Lepisosteus oculatus*) (common and scientific names according to Nelson *et al.* 2004, listed in Appendix 3) specimens collected during 2004 sampling were also fin clipped. The fin clip, taken from the caudal fin, was placed in ethanol or dried in a scale envelope.

2.5 HABITAT DATA COLLECTION

Habitat data at each of the 2004 and 2005 sites were described by recording air and water temperature, conductivity, maximum water depth, distance from shore, maximum sampling depth, substrate type, aquatic vegetation and Secchi depth. Habitat data were recorded upon completion of sampling.

All habitat data for 2004 sampling used in this report were obtained during the boat electrofishing portion of the project as habitat data collected during the fyke net portion were incomplete.

3.0 RESULTS

3.1 2004 SAMPLING

3.1.1 Boat Electrofishing - West Shore

Eight sites were sampled along the west shore with the boat electrofishing unit. The total catch for all sites was 614 fishes and the species richness was 28 (Tables 1, 2 and 3). Yellow perch (*Perca flavescens*), pumpkinseed (*Lepomis gibbosus*), emerald shiner (*Notropis atherinoides*) and bluegill (*Lepomis macrochirus*) accounted for approximately 65% of the total catch (Appendix 4). Site 4 had the lowest total catch (29) and Site 5 had the highest (206) (Appendix 4). The average CPUE was 295.47 fish/h; the average effort per site was 0.248 h; and, the total overall effort was 1.98 h (Table 4). Complete details of 2004 boat electrofishing sampling effort are in Appendix 5.

3.1.2 Fyke Nets – West Shore

A total of 329 fishes representing 23 species were caught at eight sites along the west shore of Rondeau Bay using fyke nets (Tables 1, 2 and 3). The majority of the catch was comprised of bluegill (124) and pumpkinseed (69) (Appendix 4). Site 3 had the lowest catch (19) and Site 7 had the highest (74) (Appendix 4). The average CPUE was 0.921 fish/h; the average effort per site was 44.67 h; and, the total effort expended over the eight sites was 357.35 h (Table 4). Complete details of 2004 fyke net sampling effort are in Appendix 5.

3.1.3 Boat Electrofishing – East Shore

Seven sites were sampled along the east shore of the bay; the eighth site was not sampled as the water was too shallow. The total catch of all sites combined was 1011 (Table 1). Five species made up approximately 74% of the catch: pumpkinseed, spottail shiner (*Notropis hudsonius*), bluegill, yellow perch and emerald shiner (Appendix 4). The total number of species captured was 25 (Tables 2 and 3). Sites 10 and 13 had the lowest (44) and highest (268) individual catches, respectively (Appendix 4). The average CPUE was 596.43 fish/h; the average effort per site was 0.249 h; and, the total effort expended over the seven sites was 1.74 h (Table 4).

3.1.4 Fyke Nets – East Shore

Six sites were sampled with fyke nets along the east shore producing a total catch of 279 fishes. Bluegill (137) and pumpkinseed (54) made up approximately 68% of the total catch (Table 1, Appendix 4). Species richness was 13 (Tables 2 and 3).

Sites 13 and 9 had the lowest (6) and highest (117) catch, respectively (Appendix 4). The average CPUE was 1.01 fish/h; the average effort per site was 46 h; and, the total sampling effort was 276 h (Table 4).

3.2 2005 SAMPLING

3.2.1 Seine Nets

A total of 2130 fishes, representing 24 species, were collected from 26 seine net sites in Rondeau Bay during 2005 sampling (Table 5, 6 and 7). Pumpkinseed, blackchin shiner (*Notropis heterodon*) and banded killifish (*Fundulus diaphanus*) comprised almost half the total catch (46%) (Appendix 6). Site 6 had the lowest total catch (2) and Site 5 had the highest (323). The average CPUE was 51.79 fish/haul; the average effort was 2.27 hauls; and, the total effort was 59 hauls (Table 8). Complete details of 2005 seine net sampling effort are in Appendix 7.

3.2.2 Fyke Nets

Fyke nets set at 24 sites along the coastal wetlands of Rondeau Bay yielded a total catch of 259 fishes representing 18 species (Tables 5, 6 and 7). Species composition was dominated by pumpkinseed which comprised 40% of the catch, while spotted gar (13%), bluegill (11%) and largemouth bass (*Micropterus salmoides*) (11%) were the next most abundant species (Appendix 6). The average CPUE was 0.504 fish/h; the average effort was 20.83 h; and, the total sampling effort was 500 h (Table 8). Complete details of fyke net sampling effort are in Appendix 7.

3.3 SPECIES AT RISK

2004 Sampling

Two species at risk were detected in Rondeau Bay during 2004 sampling, all of them along the west shore. Six specimens from the *Ictiobus* genus were caught at four boat electrofishing sites (Appendix 4). One spotted gar was collected at a fyke net site (Site 2), and four more were collected by boat electrofishing (Appendix 4).

2005 Sampling

DFO sampling in 2005 yielded two species at risk from Rondeau Bay: spotted gar and warmouth (*Lepomis gulosus*). Thirty-four spotted gar were detected at seven sites (4, 6, 7, 8, 9, 12 and 13), and two warmouth were collected from Site 27 (Appendix 6). Both species were only collected with fyke nets.

3.4 HABITAT DATA

2004

Every site, except for one (Site 9), had aquatic macrophytes present over at least 50% of the site (Appendix 8). The west shore sites had mostly submergent vegetation, while the east shore sites had an even mixture of both submergent and emergent vegetation (Appendix 8). Substrates were predominantly silt, sand and some detritus. Secchi depths, on average, at the west shore sites were less than those of the east shore sites (Appendix 8); however, this difference was not significant ($t = -2.13$, $df=12$, $p>0.05$).

2005

The vast majority of sites had emergent and/or submergent vegetation present over at least 50% of the site (Appendix 9). Secchi depths ranged from approximately 0.5 m to > 1 m (Appendix 9). Silt and/or detritus were the dominant substrate types at most sites, except for seven sites sampled with the 15 m boat seine where the substrate at the majority of these sites was predominantly sand (Appendix 9).

4.0 DISCUSSION

4.1 Passive vs. Active Gear Types

4.1.1 Fyke Nets vs. Boat Electrofishing – 2004

During the 2004 Rondeau Bay sampling period, boat electrofishing had a higher overall success rate, with respect to number of species and total number of fishes caught, compared to fyke netting, regardless of habitat type. More than twice as many fishes were caught using boat electrofishing (1625) than fyke netting (608) (Table 9). Two species (smallmouth bass (*Micropterus dolomieu*) and white crappie (*Pomoxis annularis*)) were collected only with fyke nets; whereas, eight species were collected only with the electrofishing unit (Tables 3 and 10). Boat electrofishing yielded a total species richness of 29, while fyke netting yielded 23 species (Table 10). The fyke nets were not as effective as the boat electrofishing unit at catching smaller species such as emerald shiner, spottail shiner, mimic shiner (*Notropis volucellus*), blackchin shiner and bluntnose minnow (*Pimephales notatus*) (Appendix 4). These fishes were likely small enough to swim out of the nets. Holland and Peters (1992) observed smaller fishes (< 150 mm) falling through the mesh of the nets as they were lifted out of the water. Although they used nets with larger mesh sizes (25, 32 and 38 mm) compared to the nets used by DFO and MNR, it would be reasonable to expect that smaller fishes

relative to the mesh size, would be able to escape the nets. Holland and Peters (1992) also discovered a pattern of decreasing CPUE with increasing mesh size within four different habitats; and, in a study comparing hoop nets with six different mesh sizes Hesse *et al.* (1982; cited in Holland and Peter 1992) determined that CPUE was greatest for the smaller mesh nets (6 and 25 mm, compared to 38, 50, 63 and 76 mm). This pattern is likely because nets with smaller mesh sizes are able to catch and retain smaller fishes and more of these fishes can be contained within a hoop net compared to larger fishes. Further explanations for the relative lack of smaller fishes caught using the fyke nets could include: large fishes move farther than small fish in a given period of time and are more likely to encounter the net (Portt *et al.* 2006); the greater catchability of large fishes using fyke nets might be due to their tendency to seek cover, which could be provided by the net (Ricker 1975; cited in Portt *et al.* 2006); and, predation on small fishes by larger fishes can occur within fyke nets, effectively biasing the sample (Portt *et al.* 2006).

Boat electrofishing was more effective at catching yellow perch and pumpkinseed (Appendix 4) while fyke netting appeared to be more effective at catching smaller largemouth bass. Of the 12 largemouth bass caught using fyke nets, only one had a total length (TL) over 100 mm. Conversely, boat electrofishing seemed to be better at catching larger individuals of largemouth bass (Table 11). Chow-Fraser *et al.* (2005) reported similar results with fyke nets and boat electrofishing: fyke nets obtained greater catches of juvenile largemouth bass while boat electrofishing was more effective at catching adult largemouths. Black crappie (*Pomoxis nigromaculatus*), white crappie and juvenile smallmouth bass were the only species for which fyke net catch rates surpassed electrofishing catch rates (Appendix 4). Previous studies have shown that both hoop nets and trap nets were selective for both crappie species (Pugh and Schramm 1998, McInerny and Cross 2004). It has been suggested the species selectivity of these types of nets is related to their ability to provide cover for cover-oriented species (Hubert and Schmitt 1982; cited in Krueger *et al.* 1998). White crappie is a cover-oriented species (Markham *et al.* 1991), as is black crappie (Keast 1968), which could be one explanation for the higher numbers of crappie caught with fyke nets compared to electrofishing. It should be noted that four out of five white crappie voucher specimens kept for laboratory identification were later re-identified as black crappie. This should be taken into consideration when examining crappie abundance.

To make a valid comparison of effort between the two gear types, it is necessary to compare the amount of time taken to obtain a sample using fyke nets (i.e. setting and fishing the nets (excluding soak time)), to electrofishing. Therefore, catch per unit effort should be measured as fish/person-hour as discussed by Pugh and Schramm (1998). However, in this case, the time it took to set and fish the fyke nets was not recorded and it is not possible to make a direct comparison to boat electrofishing. Pugh and Schramm (1998) compared electrofishing and hoop netting in the lower Mississippi River, measuring CPUE as fish/person-hour, and they found the CPUE for boat electrofishing was 5-8 times greater than hoop netting.

4.1.2 Fyke nets vs. Seine Nets - 2005

In 2005, 16 sites were sampled using both fyke nets and bag seines. Approximately four times as many fishes were captured using the seine nets (782) compared to fyke nets (196) (Table 12). Seine nets also yielded a higher species richness (22) than fyke nets (17) (Table 12).

Three sites sampled using a 9 m bag seine had almost eight times as many fishes as eight sites sampled with fyke nets (Table 12). Seven sites sampled using only a 15 m boat seine net had the highest total catch (848) compared to any of the other sites sampled using 9 m bag seines or fyke nets (Table 12). This could be a result either of the larger size of the net and its ability to cover a larger area, or the difference in habitat characteristics at these seven sites compared to the other sites. The majority of the boat seine sites had predominantly sand substrates, while the remaining 27 sites had substrates consisting mainly of silt, some sand and detritus (Appendix 9). Overall, seine nets detected seven more species than fyke nets (Table 6). The majority of these were smaller species such as the brook silverside (*Labidesthes sicculus*), blackchin shiner, spottail shiner and mimic shiner (Appendix 6). Although some smaller fishes, such as juvenile northern pike (*Esox lucius*) and largemouth bass, were captured using the fyke nets, seine nets overall were more efficient at catching larger numbers and more species of smaller fishes (Appendix 6). Both seine nets and fyke nets were successful at detecting larger individuals of species such as brown bullhead (*Ameiurus nebulosus*) and bowfin (*Amia calva*); however, more large fishes were caught with fyke nets, including common carp (*Cyprinus carpio*), longnose gar (*Lepisosteus osseus*) and spotted gar, none of which were detected using seine nets (Table 13, Appendix 6). This is probably due to the ability of larger fishes to avoid the seine net. The catchability of a given species using seine nets decreases as swimming speed increases (Bayley and

Herendeen 2000) (i.e. catchability decreases with increasing fish size (Portt *et al.* 2006)). Seine nets were more effective at detecting smaller benthic species such as darters. Two darter species (Iowa darter (*Etheostoma exile*) and johnny darter (*Etheostoma nigrum*)) were caught with seine nets; no darter species were detected using fyke nets (Appendix 6). This could be a result of the seine net covering a large area of bottom substrate during sampling, increasing the chances of encountering benthic fishes such as darters; whereas, fyke nets are set higher in the water column and are less likely to be encountered by these fishes. The limited mobility of darter species compared to larger more pelagic species likely also reduces the probability that darter species would encounter the fyke net (Portt *et al.* 2006).

As mentioned previously, to make a valid comparison of effort expended between two gear types, effort should be recorded as fish/person hour (i.e. for fyke nets the time it takes to set and fish the nets, excluding soak time). However, the time it took to set the fyke nets during the 2005 sampling was only recorded for half of the fyke net sites, and the time it took to fish the nets was not recorded for any of them. Similarly, the time it took to seine the sites and process the fish was recorded for only 12 of the 26 seine net sites. Therefore, a true comparison of effort between the two gear types cannot be done.

4.2 VARIATION BETWEEN HABITAT TYPES – 2004

4.2.1 Fyke Net Sites

Eight sites were sampled along the west shore using fyke nets, and six sites were sampled along the east shore. The west shore of Rondeau Bay is more degraded, with fewer aquatic macrophytes and higher turbidity levels (not significantly higher) due to agricultural drains and runoff. The total sampling effort was greater along the west shore as it had two more sites than the east shore. Both the average CPUE and average effort/site were slightly higher for the east shore sites when compared to the west shore sites (Table 4). Sampling along the west shore sites detected 10 more species (23) compared to the east shore sites (13). The west shore sites detected an average of 8.25 species per site while the east shore detected an average of 6.83 (Tables 2, 3 and 14); although, this difference was not significant ($t = -1.0993$, $df = 12$, $p > 0.05$). This variation could simply be due to the extra sites sampled along the west shore; however, it does not seem enough to explain the difference in species richness between the two shores. The more turbid water at the west shore sites may have played

a part in the higher total catch and higher species richness for those sites by making the nets less visible to fishes; for example, Barko *et al.* (2004) found that species richness, especially of adult fishes, decreased as Secchi depth increased.

4.2.2 Boat Electrofishing Sites

Total sampling effort and average effort per site were comparable between the two ecological areas (Table 4). However, the total catch and average CPUE from the east shore sites almost doubled that of the west shore sites (Tables 1 and 4). This could be a result of the higher level of aquatic macrophytes along the east shore, providing more habitat for more fishes. Water quality may have been better along the east shore as the shoreline is not developed. It is also possible that the turbid water along the west shore contributed to the lower total catch as the netters may not have been able to see stunned fish. In very turbid environments, it can be impossible to see stunned fish below the water surface making directed netting impossible; netters are reduced to sweeping or positioning the net behind the anode (Reynolds 1983, Port *et al.* 2006). Although the east shore sites had a higher total catch and average CPUE, the west shore yielded a higher species richness as well as a higher average species per site value (Tables 2, 3 and 14). Despite the presence of suitable habitat, goldfish (*Carassius auratus*), longnose gar, northern pike and spotted gar were not detected along the east shore. It is possible that the clear waters along the east snore allowed these fishes to see and avoid the electrofishing boat. McInerny and Cross (1996) observed largemouth bass actively avoiding the electrofishing boat in Minnesota lakes with clear water. Another reason for lower detection along the east shore could have been the difficulty in sampling some of the marsh cells that are found along that shore. Some of these cells were not sampled as the boat was too large to access them and the sampling efficiency in other marsh cells may not have been maximized because of the difficulty in manoeuvring the boat.

4.3 SPECIES AT RISK

2004

One of the objectives of the 2004 survey was to examine the status and distribution of fish species at risk within the littoral habitats of Rondeau Bay. Historical records exist for four fish species at risk within the bay. They are (their status as designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in parentheses): lake chubsucker (*Erimyzon sucetta*) (Threatened);

pugnose shiner (*Notropis anogenus*) (Endangered); spotted gar (Threatened); and, warmouth (Special Concern). Of these four species, only spotted gar were detected during the 2004 sampling period. The bigmouth buffalo (*Ictiobus cyprinellus*) (Special Concern) was only recently detected in Rondeau Bay (2002) during a DFO survey monitoring the status of spotted gar (N.E. Mandrak, DFO, unpubl. data). Specimens from the *Ictiobus* genus were detected again during the 2004 sampling. These individuals had a subterminal mouth and, thus, were not bigmouth buffalo (Mandrak and Cudmore 2006). Tissue samples were taken for DNA analyses to determine whether the *Ictiobus* specimens were black buffalo (*Ictiobus niger*) (Special Concern) or smallmouth buffalo (*Ictiobus bubalus*), as distinguishing between these two species using physical characteristics alone is very difficult (H. Bart, Tulane University, pers.comm.).

The first record of spotted gar in Rondeau Bay was collected in 1955 and, prior to 2004, less than 50 spotted gar specimens had been collected in Canada, 19 of which were caught in Rondeau Bay (Mandrak and Cudmore-Vokey 2004a).

Both the spotted gar and *Ictiobus* specimens were only detected along the west shore of the bay during the 2004 sampling period. All six *Ictiobus* specimens, and four of five spotted gar specimens, were collected using the boat electrofishing unit (Appendix 4). It is not known why spotted gar or *Ictiobus* sp. were not detected along the east shore during 2004 sampling. The habitat along that shore appeared suitable for both species, which both prefer slow, shallow, vegetated, clear water; although, *Ictiobus* sp. can tolerate high turbidity and low dissolved oxygen levels (Mandrak and Cudmore-Vokey 2004a).

No lake chubsucker or pugnose shiner were detected during the 2004 sampling period, which could be a result of the gear type used. Some species are caught more readily using specific gear types; a combination of boat electrofishing and boat seining is very effective at detecting pugnose shiner and lake chubsucker (N.E. Mandrak, DFO, unpubl. data). However, despite sampling in the 1980s and 1990s, the pugnose shiner has not been recorded in Rondeau Bay since 1963, and it is probable that a population no longer exists in the bay (Holm and Mandrak 2002). The lake chubsucker has not been collected from Rondeau Bay since 1983; however, it is believed that they may still be present and may be detected with more intensive sampling (Mandrak and Crossman 1994). Although the 2004 sampling was intensive, it did not include the use of seine

nets, which have been shown to be very effective at detecting lake chubsucker (N.E. Mandrak, DFO, unpubl. data).

Warmouth was first reported in Canada at Rondeau Bay in 1966 and has since been detected in the bay in 1967, 1968 and 1999 (Mandrak and Cudmore-Vokey 2004b). As only a few specimens were collected each time, it is not clear if there is an established population in the bay, or if these fish were strays from Point Pelee (Mandrak and Cudmore-Vokey 2004b). No warmouth were detected during the 2004 sampling, although suitable habitat was sampled.

2005

Two species at risk were detected during the 2005 survey along the inner coastal wetlands of the east shore of Rondeau Bay. Thirty-four spotted gar were captured from seven fyke net sites and two warmouth were collected from one fyke net site (Appendix 6). Spotted gar was caught exclusively with fyke nets in sites located in the southeast corner of the bay. These sites were sampled in May when water levels were high in the back waters and side channels of the wetland. Due to lower water levels in July and August, which made navigating these inner coastal wetlands impossible, the sites were not re-sampled. Spotted gar was not detected during either of the sampling events in July or August. Aquatic macrophytes were present at spotted gar capture sites and the same bottom substrate (silt) was present at each site.

As with spotted gar, warmouth was also only detected with the fyke nets. Although suitable habitat was present at most of the 34 sites sampled in 2005, warmouth was only detected at one site (27). As mentioned previously, the low numbers of warmouth collected in Rondeau Bay make it difficult to determine whether there is an established population present, and it is possible that the specimens collected are strays. Site 27, where two warmouth were captured, is located at the northeast corner of the bay (Figure 2, Appendix 6). This site had a predominantly sand bottom with some silt present, and submergent vegetation was present over approximately 60% of the site (Appendix 9).

Pugnose shiner and lake chubsucker were not found in Rondeau Bay during 2005 sampling despite intensive sampling of suitable habitats and the use of seine nets, which have proven effective at detecting both species (see above).

5.0 RECOMMENDATIONS

When using multiple gear types to survey sites in a standardized manner, it is important that sites are sampled at the same time or within days with each gear type. This reduces the influence of confounding factors on the comparison (e.g. seasonal variation in fish assemblages and seasonal variation in fish and physical habitat). In studies comparing boat electrofishing to fyke nets and hoop nets, sampling using the various gear types was done within days of each other (Pugh and Schramm 1998, Chow-Fraser *et al.* 2005).

Completed field sheets are very important when it comes to looking for trends in catch data (i.e. numbers caught, species caught); if data are not recorded completely, it is difficult to draw conclusions. Field sheets should be familiar to all involved in data collection and the importance of having them filled out completely and properly should be emphasized.

Future sampling of Rondeau Bay should incorporate fyke nets of different mesh sizes as different mesh sizes have been shown to be size and species selective (Holland and Peters 1992). Having different mesh sizes may increase the likelihood of obtaining a more representative sample of the fish assemblage. Night sampling using active gear types, such as electrofishing and seine nets, should also be considered for future sampling in the bay as various studies have demonstrated that higher CPUE and species richness values are obtained when sampling at night compared to day sampling (e.g. Paragamian 1989, Dumont and Dennis 1993, McInerny and Cross 2000, 2004, Pierce *et al.* 2001). The use of short gill net sets should be considered as gill nets have been shown to be effective at detecting buffalo species (Jester 1977, N.E. Mandrak, DFO, unpubl. data). Further sampling should also be conducted in the back channels and intermittently flooded areas of the bay during the spring months (or whenever water levels permit access) using a boat electrofishing unit and a boat seine. A combination of these gear types has been shown to be effective at detecting lake chubsucker and pugnose shiner (N.E. Mandrak, DFO, unpubl. data).

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Table 1. Summary of catch data for fyke netting and boat electrofishing, Rondeau Bay 2004.

	Gear Type			
	Boat Electrofishing		Fyke Netting	
Catch Data	East Shore	West Shore	East Shore	West Shore
Total Fishes Caught	1011	614	279	329
Average Fishes Caught/Site	144.43	76.75	46.5	41.13
Minimum Fishes Caught/Site	44	29	6	19
Maximum Fishes Caught/Site	268	206	117	74

Table 2. Summary of species captured using boat electrofishing and fyke netting along the east and west shores of Rondeau Bay, 2004.

	Gear Type			
	Boat Electrofishing		Fyke Netting	
	East Shore	West Shore	East Shore	West Shore
Species Richness	25	28	13	23
Unique Species	1	4	0	10
Common Species	**24**		**13**	
Total Species Richness	**29**		**23**	

Table 3. Species captured by boat electrofishing and fyke netting, Rondeau Bay 2004.

	Gear Type			
	Boat Electrofishing		Fyke Netting	
Species	**East Shore**	**West Shore**	**East Shore**	**West Shore**
banded killifish				
black bullhead				
black crappie				
blackchin shiner				
bluegill				
bluntnose minnow				
bowfin				
brook silverside				
brown bullhead				
common carp				
emerald shiner				
freshwater drum				
gizzard shad				
golden shiner				
goldfish				
Ictiobus sp.				
largemouth bass				
longnose gar				
mimic shiner				
northern pike				
pumpkinseed				
rock bass				
round goby				
smallmouth bass				
spotfin shiner				
spottail shiner				
spotted gar				
white crappie				
white perch				
yellow bullhead				
yellow perch				
Total Species Richness	**25**	**28**	**13**	**23**

Legend	Present	Absent

Table 4. Summary of sampling effort using fyke nets and boat electrofishing, Rondeau Bay 2004.

	Gear Type			
	Boat Electrofishing		Fyke Netting	
Sampling Effort	**East Shore**	**West Shore**	**East Shore**	**West Shore**
Average CPUE (fish/h)	596.43	295.47	1.01	0.921
Average Effort/Site (h)	0.249	0.248	46	44.67
Total Sampling Effort (h)	1.74	1.98	276	357.35

Table 5. Summary of catch data for fyke nets and seine nets, Rondeau Bay 2005.

	Gear Type	
	Fyke Netting	Seine Netting
Catch Data		
Total Fishes Caught	259	2130
Average Fishes Caught/Site	10.79	81.92
Minimum Fishes Caught/Site	1	2
Maximum Fishes Caught/Site	41	323

Table 6. Summary of species caught with fyke nets and seine nets, Rondeau Bay 2005.

	Gear Type	
	Fyke Net	Seine Net
Species Richness	18	24
Unique Species	4	11
Common Species	**14**	
Total Species Richness	**28**	

Table 7. Species captured in Rondeau Bay, 2005.

	Gear Type	
Species	**Fyke Net**	**Seine Net**
Ameiurus sp.		
banded killifish		
black crappie		
blackchin shiner		
bluegill		
bluntnose minnow		
bowfin		
brook silverside		
brown bullhead		
central mudminnow		
common carp		
fathead minnow		
golden shiner		
lowa darter		
johnny darter		
largemouth bass		
longnose gar		
mimic shiner		
northern pike		
pumpkinseed		
rock bass		
round goby		
smallmouth bass		
spottail shiner		
spotted gar		
tadpole madtom		
warmouth		
yellow perch		
Total Species Richness	**18**	**24**

Legend	Present	Absent

Table 8. Total sampling effort for fyke net and seine net sites, Rondeau Bay 2005.

	Gear Type	
	Fyke Net	**Seine Net**
Sampling Effort		
Average CPUE	0.504 fish/h	51.79 fish/haul
Average Effort/Site	20.83 hours	2.27 hauls
Total Sampling Effort	500 hours	59 hauls

Table 9. Summary of catch data for fyke net and boat electrofishing sites, Rondeau Bay 2004.

	Gear Type	
Catch Data	**Fyke Netting**	**Boat Electrofishing**
Total Fishes Caught	608	1625
Average Fish Caught/Site	43.43	108.33
Minimum Fish Caught/Site	6	29
Maximum Fish Caught/Site	117	268

Table 10. Summary of species captured by boat electrofishing and fyke netting, Rondeau Bay 2004.

	Gear Type	
	Fyke Netting	**Boat Electrofishing**
Species Richness	23	29
Unique Species	2	8
Common Species	**21**	
Total Species Richness (Boat Electrofishing + Fyke net)	**31**	

Table 11. Total catch and total lengths (TL) (mm) for largemouth bass caught with boat electrofishing and fyke nets at 2004 Rondeau Bay sites.

Site	Gear Type	Minimum (mm)	Maximum (mm)	Number Captured
1	Boat Electrofishing	312	312	1
2	Boat Electrofishing	280	280	1
5	Boat Electrofishing	222	367	5
6	Boat Electrofishing	231	319	4
7	Boat Electrofishing	360	372	2
8	Boat Electrofishing	405	405	1
9	Boat Electrofishing	319	400	7
10	Boat Electrofishing	261	331	4
11	Boat Electrofishing	20	399	12
12	Boat Electrofishing	137	216	2
14	Boat Electrofishing	294	378	4
15	Boat Electrofishing	26	373	7
Average Length (mm) - electrofishing		**238.92**	**346**	**Total 50**
2	Fyke Netting	50	50	1
3	Fyke Netting	44	49	2
6	Fyke Netting	52	52	1
7	Fyke Netting	40	45	2
12	Fyke Netting	327	327	1
13	Fyke Netting	49	82	3
14	Fyke Netting	34	57	2
Average Length (mm) – fyke netting		**85.14**	**94.57**	**Total 12**

Table 12. Total catch and species richness at 2005 Rondeau Bay sites.

	Fyke Net (Sites 1-4, 6-9, 12-15, 24-27)	9 m Bag Seine (Sites 1-4, 6-9, 12-15, 24-27)	Fyke Net (Sites 16-23)	9 m Bag Seine (Sites 5, 10, 11)	15 m Boat Seine (Sites 28-34)
Total Catch	196	782	63	490	848
Species Richness	17	22	10	9	14

Table 13. Total numbers caught and total lengths (TL) of larger species (> 200 mm adult TL) caught using fyke nets and seine nets, Rondeau Bay, 2005.

	Gear Type			
	Fyke Net		Seine Net	
Species	# caught	Min/Max TL (mm)	# caught	Min/Max TL (mm)
bowfin	8	480-693	1	574
brown bullhead	4	295-327	1	306
common carp	2	605-656	0	-
largemouth bass	28	46-405	167	41-225
longnose gar	4	619-952	0	-
northern pike	4	33-655	17	31-296
smallmouth bass	0	-	1	206
spotted gar	34	480-691	0	-

Table 14. Average number of species caught per site at fyke net and boat electrofishing sites, Rondeau Bay 2004.

	Species Numbers Per Site			
Site	Boat Electrofishing East Shore	Boat Electrofishing West Shore	Fyke Nets East Shore	Fyke Nets West Shore
1	-	12	-	6
2	-	15	-	10
3	-	11	-	8
4	-	12	-	10
5	-	23	-	5
6	-	15	-	7
7	-	15	-	13
8	-	10	-	7
9	13	-	9	-
10	13	-	5	-
11	14	-	9	-
12	12	-	8	-
13	14	-	5	-
14	10	-	5	-
15	12	-	-	-
Average Species/Site	**12.57**	**14.13**	**6.83**	**8.25**

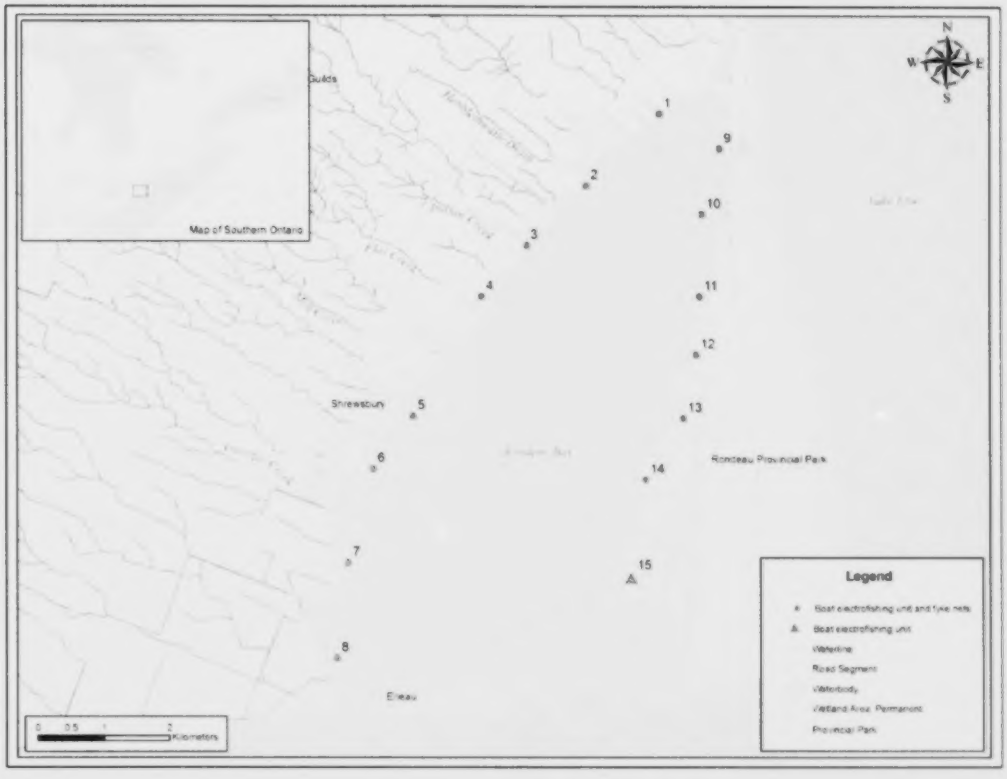

Figure 1. Sites sampled in Rondeau Bay in 2004. Numbers on the map correspond to site codes in Appendix 1.

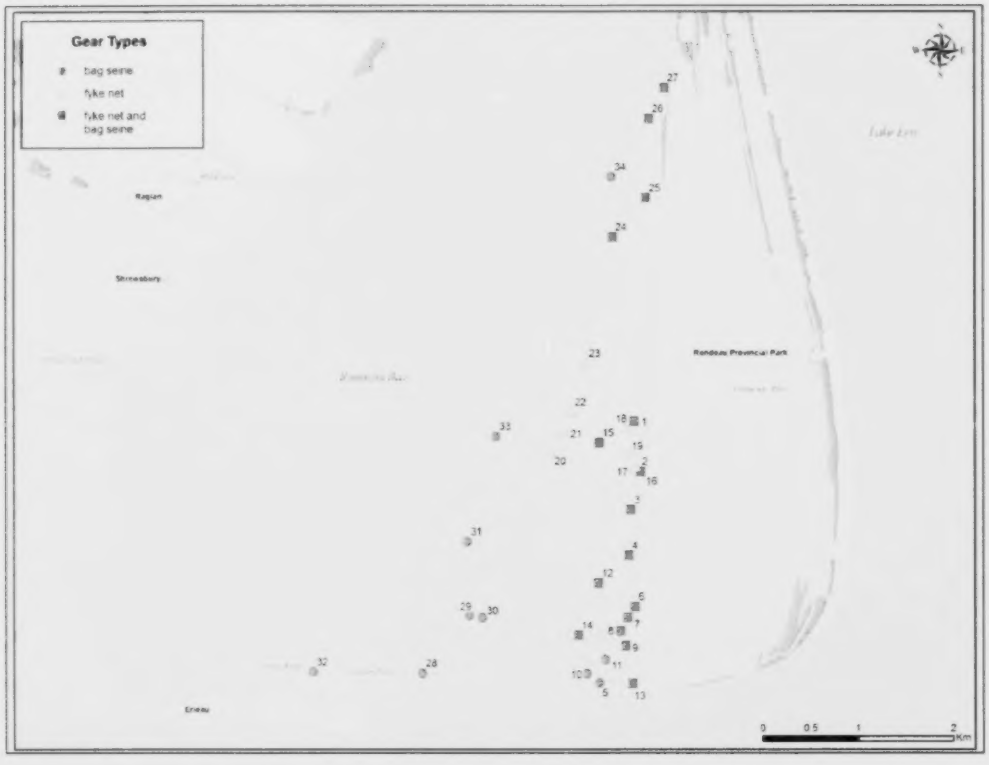

Figure 2. Sites sampled in Rondeau Bay in 2005. Numbers on the map correspond to site codes in Appendix 2.

Appendix 1. Site descriptions for 2004 Rondeau Bay sampling.

Site	Field Number	Date	Narrative Locality Description	Start Latitude	Start Longitude
1	RONCOA04BE220604001	22/06/2004	NE corner of bay; NW shore, NE of Rondeau Bay Estates	42.33139	-81.85772
2	RONCOA04BE220604002	22/06/2004	NE corner of bay; NW shore, SW of Rondeau Bay Estates	42.32404	-81.87370
3	RONCOA04BE220604003	22/06/2004	NW shore; mouth of Indian Creek; East of Shrewsbury	42.31787	-81.88674
4	RONCOA04BE220604004	22/06/2004	NW shore; mouth of Flat Creek	42.31245	-81.89675
5	RONCOA04BE230604005	23/06/2004	NW shore; NE of Shrewsbury Dock	42.29864	-81.91352
6	RONCOA04BE230604006	23/06/2004	NW shore; SW of Shrewsbury Dock	42.29282	-81.92273
7	RONCOA04BE230604007	23/06/2004	NW shore; off of point SW of Georgie Creek	42.28117	-81.93080
8	RONCOA04BE230604008	23/06/2004	NW shore; N of Erieau, SW corner of Rondeau Bay	42.26895	-81.93645
9	RONCOA04BE290604009	29/06/2004	NE corner of bay; SE shore, adjacent to Rondeau Park marina	42.32502	-81.84845
10	RONCOA04BE280604010	28/06/2004	NE corner of bay; SE shore, SW of Yacht Club	42.31688	-81.85414
11	RONCOA04BE280604011	28/06/2004	SE shore; Rondeau Provincial Park, directly opposite mouth of Indian Creek	42.30612	-81.85772
12	RONCOA04BE280604012	28/06/2004	SE shore; S of Rondeau Marsh lookout	42.29859	-81.86063
13	RONCOA04BE290604013	29/06/2004	SE shore; N of duck blind	42.29055	-81.86547
14	RONCOA04BE290604014	29/06/2004	SE shore; opposite Shrewsbury docks	42.28357	-81.87453
15	RONCOA04BE290604015	29/06/2004	SE shore; opposite Georgie Creek	42.27096	-81.88099
1	RONCOA04HN260704001A	26/07/2004	NE corner of bay; NW shore, NE of Rondeau Bay Estates	42.33139	-81.85772
	RONCOA04HN260704001B	26/07/2004	NE corner of bay; NW shore, NE of Rondeau Bay Estates	42.32975	-81.86116
2	RONCOA04HN260704002A	26/07/2004	NE corner of bay; NW shore, SW of Rondeau Bay Estates	42.32639	-81.87184
	RONCOA04HN260704002B	26/07/2004	NE corner of bay; NW shore, SW of Rondeau Bay Estates	42.32403	-81.87368
3	RONCOA04HN270704003A	27/07/2004	NW shore; mouth of Indian Creek; East of Shrewsbury	42.32006	-81.88337
	RONCOA04HN270704003B	27/07/2004	NW shore; mouth of Indian Creek; East of Shrewsbury	42.31787	-81.88674
4	RONCOA04HN270704004A	27/07/2004	NW shore; mouth of Flat Creek	42.31245	-81.89675
	RONCOA04HN270704004B	27/07/2004	NW shore; mouth of Flat Creek	42.30995	-81.89870
5	RONCOA04HN280704005A	28/07/2004	NW shore; NE of Shrewsbury Dock	42.29864	-81.91352
	RONCOA04HN280704005B	28/07/2004	NW shore; NE of Shrewsbury Dock	42.29662	-81.91742
6	RONCOA04HN280704006A	28/07/2004	NW shore; SW of Shrewsbury Dock	42.29282	-81.92273
	RONCOA04HN280704006B	28/07/2004	NW shore; SW of Shrewsbury Dock	42.29109	-81.92543

Appendix 1. Continued.

Site	Field Number	Date	Narrative Locality Description	Start Latitude	Start Longitude
7	RONCOA04HN290704007A	29/07/2004	NW shore; off of point SW of Georgie Creek	42.28117	-81.93080
	RONCOA04HN290704007B	29/07/2004	NW shore; off of point SW of Georgie Creek	42.27855	-81.93150
8	RONCOA04HN290704008A	29/07/2004	NW shore; N of Erieau, SW corner of Rondeau Bay	42.26895	-81.93645
	RONCOA04HN290704008B	29/07/2004	NW shore; N of Erieau, SW corner of Rondeau Bay	42.26609	-81.93517
9	RONCOA04HN040804009A	04/08/2004	NE corner of bay; SE shore, adjacent to Rondeau Park marina	42.32502	-81.84845
	RONCOA04HN040804009B	04/08/2004	NE corner of bay; SE shore, adjacent to Rondeau Park marina	42.32200	-81.84877
10	RONCOA04HN040804010A	04/08/2004	NE corner of bay; SE shore, SW of Yacht Club	42.31688	-81.85414
	RONCOA04HN040804010B	04/08/2004	NE corner of bay; SE shore, SW of Yacht Club	42.31415	-81.85656
11	RONCOA04HN050804011A	05/08/2004	SE shore; Rondeau Provincial Park, directly opposite mouth of Indian Creek	42.30612	-81.85772
	RONCOA04HN050804011B	05/08/2004	SE shore; Rondeau Provincial Park, directly opposite mouth of Indian Creek	42.30342	-81.85875
12	RONCOA04HN050804012A	05/08/2004	SE shore; S of Rondeau Marsh lookout	42.29859	-81.86063
	RONCOA04HN050804012B	05/08/2004	SE shore; S of Rondeau Marsh lookout	42.29660	-81.86334
13	RONCOA04HN060804013A	06/08/2004	SE shore; N of duck blind	42.49055	-81.86547
	RONCOA04HN060804013B	06/08/2004	SE shore; N of duck blind	42.28805	-81.86722
14	RONCOA04HN060804014A	06/08/2004	SE shore; opposite Shrewsbury docks	42.28357	-81.87453
	RONCOA04HN060804014B	06/08/2004	SE shore; opposite Shrewsbury docks	42.28071	-81.87534

Appendix 2. Site descriptions for 2005 Rondeau Bay sampling.

Site	Field Number	Date	Narrative Locality Description	Start Latitude	Start Longitude
1	RDB05052505001a and b	25/05/2005	Approximately 2 km north of the southern-most end of Long Pond. Sampling on west bank.	42.27902	-81.86747
2	RDB05052505002a and b	25/05/2005	Approximately 1.6 km north of southern-most end of Long Pond. Sampling on east bank	42.27435	-81.86800
3	RDB05052505003a and b	25/05/2005	Approximately 1200 m north from the southernmost tip of 'Long Pond'	42.27112	-81.87022
4	RDB05052505004a and b	25/05/2005	Approximately 800 m north of southernmost tip of 'Long Pond'. Sampling on the east side of submergent island	42.26704	-81.87167
5	RDB05052505005	25/05/2005	Approximately 200 m southeast of end of the park dyke road; along Erie berm	42.25617	-81.87861
6	RDB05052605001a and b	26/05/2005	Approximately 700 m north of the southernmost end of 'Long Pond'. Sampling on east bank.	42.26231	-87.227
7	RDB05052605002a and b	26/05/2005	Approximately 500 m north of the southernmost end of 'Long Pond'. Sampled on west bank.	42.26149	-81.87346
8	RDB05052605003a and b	26/05/2005	Approximately 200 m north of the southernmost end of 'Long Pond'. Sampled on west bank.	42.26041	-81.87474
9	RDB05052605004a and b	26/05/2005	Approximately 75 m north of the southernmost end of 'Long Pond'. Sampled on the east bank.	42.25896	-81.87444
10	RDB05052605005	26/05/2005	Approximately 175 m east of end of Rondeau Dyke Road (adjacent to main cut). Sampled south bank.	42.25724	-81.87989
11	RDB05052605006	26/05/2005	Approximately 250 m east northeast of end of Park Dyke Road.	42.25815	-81.87725
12	RDB05052705001a and b	27/05/2005	Approximately 350 m northeast of southernmost tip of Park Dyke Road. Sampled on west bank.	42.26514	-81.8761
13	RDB05052705002a and b	27/05/2005	Approximately 150 m northeast of the southernmost tip of the Park Dyke Road. Sampled on the east side.	42.15693	-81.52567
14	RDB05052705003a and b	27/05/2005	Approximately 150 m north of the southernmost tip of the Park Dyke Road. Sampled within the 'main cut'; west bank.	42.26087	-87.87994

Appendix 2. Continued.

Site	Field Number	Date	Narrative Locality Description	Start Latitude	Start Longitude
15	RDB05052705004a and b	27/05/2005	Approximately 600 m south of boat launch at base of Dyke Road. Sampled in pond-like clearing extending of 'main cut'; east bank.	42.27775	-81.87226
16	RDB05072605001	26/07/2005	Across from duck blind #27.	42.2748	-81.8683
17	RDB05072605002	26/07/2005	Adjacent to duck blind #27.	42.27481	-81.86876
18	RDB05072605003	26/07/2005	Adjacent to duck blind #27.	42.27855	-81.86851
19	RDB05072605004	26/07/2005	Across from duck blind #27; in shallow inland pond	42.27634	-81.86896
20	RDB05072705001	27/07/2005	East side of Rondeau Bay; 500 m south of lookout.	42.27788	-81.87845
21	RDB05072705002	27/07/2005	East shore of Rondeau Bay; 450 m south of lookout.	42.27934	-81.87621
22	RDB05072705003	27/07/2005	East shore of Rondeau Bay; 400 m south of lookout.	42.28107	-81.87477
23	RDB05072705004	27/07/2005	East bank of bay; 375 m south of lookout.	42.28516	-81.87178
24	RDB05072805001 and 2	28/07/2005	East shore; 250 m south of lookout.	42.29598	-81.86521
25	RDB05072805003 and 4	28/07/2005	East bank; 175 m south of lookout.	42.29885	-81.86008
26	RDB05072805005 and 6	28/07/2005	East shore; 175 m north of lookout	42.30591	-81.8576
27	RDB05072805007 and 8	28/07/2005	East shore; 300 m north of lookout.	42.3084	-81.85492
28	RDB05170805001	17/08/2005	Erieau Beach; Inner Rondeau Bay	42.2605	-81.89969
29	RDB05170805002	17/08/2005	Southeast corner of Rondeau Bay; sand flats, open water	42.26475	-81.89244
30	RDB05170805003	17/08/2005	n/a	42.26431	-81.89091
31	RDB05170805004	17/08/2005	Open water seine haul; west of Pointe Aux Pins	42.27144	-81.89074
32	RDB05170805005	17/08/2005	East side of Point Post; Rondeau Bay	42.26278	-81.91302
33	RDB05170805006	17/08/2005	Rondeau Bay; 350 m off shore of marsh, on sand flat	42.28036	-81.88447
34	RDB05170805007	17/08/2005	Open water sand flat; southwest of observation tower at provincial park.	42.30142	-81.86371

Appendix 3. Common and scientific names of fishes caught in Rondeau Bay in 2004 and 2005 (according to Nelson *et al.* 2004).

Scientific Name	Common Name
Ambloplites rupestris	rock bass
Ameiurus melas	black bullhead
Ameiurus natalis	yellow bullhead
Ameiurus nebulosus	brown bullhead
Amia calva	bowfin
Aplodinotus grunniens	freshwater drum
Carassius auratus	goldfish
Cyprinella spiloptera	spotfin shiner
Cyprinus carpio	common carp
Dorosoma cepedianum	gizzard shad
Esox lucius	northern pike
Etheostoma exile	Iowa darter
Etheostoma nigrum	johnny darter
Fundulus diaphanus	banded killifish
Ictiobus sp.	buffalo sp.
Labidesthes sicculus	brook silverside
Lepisosteus oculatus	spotted gar
Lepisosteus osseus	longnose gar
Lepomis gibbosus	pumpkinseed
Lepomis gulosus	warmouth
Lepomis macrochirus	bluegill
Micropterus dolomieu	smallmouth bass
Micropterus salmoides	largemouth bass
Morone americana	white bass
Neogobius melanostomus	round goby
Notemigonus crysoleucas	golden shiner
Notropis atherinoides	emerald shiner
Notropis heterodon	blackchin shiner
Notropis hudsonius	spottail shiner
Notropis volucellus	mimic shiner
Noturus gyrinus	tadpole madtom
Perca flavescens	yellow perch
Pimephales notatus	bluntnose minnow
Pimephales promelas	fathead minnow
Pomoxis annularis	white crappie
Pomoxis nigromaculatus	black crappie
Umbra limi	central mudminnow

Appendix 4. Species caught in Rondeau Bay, 2004.

	Gear Type															
	Fyke Netting – West Shore									Fyke Netting – East Shore						
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**	**9**	**10**	**11**	**12**	**13**	**14**	**Total**
black bullhead				1					**1**							**0**
black crappie		13	3	5		2			**23**	1						**1**
blackchin shiner							1		**1**							**0**
bluegill	5	6		2	14	34	37	26	**124**	81	13	20	20		3	**137**
bluntnose minnow				1			1	1	**3**							**0**
bowfin		4	1	2					**7**	3		2		1	4	**10**
brown bullhead		1	1	2	1		2	2	**9**	1	4	1	2	1	2	**11**
common carp	1						1		**2**			1		1		**2**
emerald shiner		1							**1**							**0**
gizzard shad			4	4					**8**							**0**
golden shiner							1	2	**3**							**0**
largemouth bass		2	1			3	2		**8**				1	2	1	**4**
northern pike		1							**1**							**0**
pumpkinseed	4		7	3	14	9	21	11	**69**	10		23	20		1	**54**
rock bass	1				3		1	1	**6**	1	3	3	2			**9**
round goby						1			**1**	6	1		1			**8**
smallmouth bass		1	1						**2**	11	1	4				**16**
spotfin shiner							1		**1**							**0**
spottail shiner				4		1	1		**6**			19				**19**
spotted gar		1							**1**							**0**
white crappie	30		1				1		**32**				1	1		**2**
white perch				1					**1**							**0**
yellow perch	1	5			1	6	4	2	**19**	3		1	2			**6**
Total	**42**	**35**	**19**	**25**	**33**	**56**	**74**	**45**	**329**	**117**	**22**	**74**	**49**	**6**	**11**	**279**

Appendix 4. Continued.

	Gear Type															
	Boat Electrofishing – West Shore									Boat Electrofishing – East Shore						
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
banded killifish			1		1				**2**					2		2	**4**
black bullhead							1		**1**		1	1			1		**3**
blackchin shiner					5				**5**		8	2	4	3		19	**36**
bluegill	10	4	2	1	20	5	7	5	**54**	10		17	15	39	20	32	**133**
bluntnose minnow	4	4	1		8	1		8	**26**	1	1	13	20	35	1	5	**76**
bowfin	1	1			1	3	2	1	**9**		1	2	1	1	3	1	**9**
brook silverside		1		1	3			2	**7**	3	1						**4**
brown bullhead	2	2	3	6	7	4	1	5	**30**	1	2	1	1		2		**7**
common carp	4	1		2	2	1	1	9	**20**		1	1				1	**3**
emerald shiner		13	1	3	42	19	2	1	**81**	97	1			1			**99**
freshwater drum					1				**1**						2		**2**
gizzard shad	1	1		1	1		2		**6**	2							**2**
golden shiner				1	7	11	4		**23**	1	1		2	1			**5**
goldfish					1				**1**								**0**
Ictiobus sp.		3	1	1			1		**6**								**0**
largemouth bass	1	1			5	4	2	1	**14**	2	7	4	12	2	4	7	**38**
longnose gar					3	2			**5**								**0**
mimic shiner					2				**2**	1	6	7	29	16		4	**63**
northern pike						1			**1**								**0**
pumpkinseed	19	3	8	3	24	12	5	37	**111**	41	3	38	34	37	39	69	**261**
rock bass					2	1	1		**4**					1			**1**
round goby									**0**			1					**1**
spotfin shiner		1							**1**				2				**2**
spottail shiner	1	1		1	10	4	3		**20**	1		6	16	115		11	**149**
spotted gar	1		1		2				**4**								**0**
white crappie			1		2				**3**						1	1	**2**
white perch	1	11	3	2	2	1			**20**	4							**4**
yellow bullhead							1		**1**			2		1			**3**
yellow perch	9	8	8	7	55	24	26	19	**156**	38	11	13	8	14	12	8	**104**
Total	**54**	**55**	**30**	**29**	**206**	**93**	**59**	**88**	**614**	**202**	**44**	**108**	**144**	**268**	**85**	**160**	**1011**

Appendix 5. Sampling gear and effort used in Rondeau Bay, 2004.

Site	Date	Duration	Units	Description of Method	Electrofishing Settings
1	22/06/2004	807	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 8 amps, 30 Hz @ 50%
2	22/06/2004	801	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 7.5 amps, 30 Hz @ 50%
3	22/06/2004	921	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 7 amps, 30 Hz @ 50%
4	22/06/2004	851	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 7 amps, 30 Hz @ 50%
5	23/06/2004	1136	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 8 amps, 30 Hz @ 50%
6	23/06/2004	913	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 7 amps, 30 Hz @ 50%
7	23/06/2004	837	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 7 amps, 30 Hz @ 50%
8	23/06/2004	870	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 7 amps, 30 Hz @ 60%
9	29/06/2004	660	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 6 amps, 30 Hz @ 50%
10	28/06/2004	775	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 6 amps, 30 Hz @ 50%
11	28/06/2004	958	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 6 amps, 30 Hz @ 50%
12	28/06/2004	928	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 6 amps, 30 Hz @ 50%
13	29/06/2004	947	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 6 amps, 30 Hz @ 50%
14	29/06/2004	1037	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 7 amps, 30 Hz @ 50%
15	29/06/2004	978	Seconds	E-fishing Boat SR-20, 6 m, 7.5 GPP,dual boom	1000V, 6 amps, 30 Hz @ 60%
1	26/07/2004	20.5	Hours	1.2 m fyke net, 6.35 mm mesh	-
	26/07/2004	20.5	Hours	1.2 m fyke net, 6.35 mm mesh	-
2	26/07/2004	19.25	Hours	1.2 m fyke net, 6.35 mm mesh	-
	26/07/2004	20	Hours	1.2 m fyke net, 6.35 mm mesh	-
3	27/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
	27/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
4	27/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
	27/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
5	28/07/2004	22.5	Hours	1.2 m fyke net, 6.35 mm mesh	-
	28/07/2004	24	Hours	1.2 m fyke net, 6.35 mm mesh	-
6	28/07/2004	22.6	Hours	1.2 m fyke net, 6.35 mm mesh	-
	28/07/2004	24	Hours	1.2 m fyke net, 6.35 mm mesh	-

Appendix 5. Continued.

Site	Date	Duration	Units	Description of Method	Electrofishing Settings
7	29/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
	29/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
8	29/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
	29/07/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
9	04/08/2004	22	Hours	1.2 m fyke net, 6.35 mm mesh	-
	04/08/2004	22	Hours	1.2 m fyke net, 6.35 mm mesh	-
10	04/08/2004	22	Hours	1.2 m fyke net, 6.35 mm mesh	-
	04/08/2004	22	Hours	1.2 m fyke net, 6.35 mm mesh	-
11	05/08/2004	24	Hours	1.2 m fyke net, 6.35 mm mesh	-
	05/08/2004	24	Hours	1.2 m fyke net, 6.35 mm mesh	-
12	05/08/2004	24	Hours	1.2 m fyke net, 6.35 mm mesh	-
	05/08/2004	24	Hours	1.2 m fyke net, 6.35 mm mesh	-
13	06/08/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
	06/08/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
14	06/08/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-
	06/08/2004	23	Hours	1.2 m fyke net, 6.35 mm mesh	-

Appendix 6. Species caught in Rondeau Bay in 2005.

	Gear Type																								
	Fyke Net																								
Site	**1**	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**Total**
Species																									
banded killifish																1									**1**
black crappie																					2	1			**3**
bluegill					1	1	4	1	2	1		2				1	1		4	1	5	2	3		**29**
bluntnose minnow		1																			1	1			**3**
bowfin	1		1		2						2							1						1	**8**
brown bullhead												1						1						2	**4**
central mudminnow												1													**1**
common carp						1																	1		**2**
golden shiner		1				2						3													**6**
largemouth bass					1			1	1				3	2	3		7		1	1	4	4			**28**
longnose gar		2				1				1															**4**
northern pike							2							1										1	**4**
pumpkinseed	1			1	1	5	5	1	32	1	1	11	4	6	1	6	9		1	1	8	1	4	4	**104**
rock bass										1										1	1			3	**6**
spotted gar				3	1	2	6	7	4	11															**34**
tadpole madtom						4	1		2	2				1	1										**11**
warmouth																								2	**2**
yellow perch	1						2					2		1			2		1						**9**
Total	**3**	**4**	**1**	**4**	**6**	**16**	**20**	**10**	**41**	**17**	**3**	**20**	**7**	**11**	**5**	**8**	**19**	**2**	**7**	**4**	**21**	**9**	**8**	**13**	**259**

Appendix 6. Continued.

	Gear Type															
	Seine Net															
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
Species																
Ameiurus sp.																**2**
banded killifish	3			5	20		1	2		66	1	15		19	2	**214**
black crappie																**1**
blackchin shiner	7		1	1	148	1	8	14		39	3	6	1	52		**337**
bluegill	8		9	1	8		4	19	3		1			3		**155**
bluntnose minnow					5			3	1	17	1	1		5		**188**
bowfin																**1**
brook silverside				2										1		**166**
brown bullhead									1							**1**
central mudminnow												1				**1**
Esox sp.				1												**1**
fathead minnow			1													**1**
golden shiner	1		1				1							1		**4**
Iowa darter	1		1	1			1				2			1	2	**12**
johnny darter								1								**16**
largemouth bass	1															**167**
Lepomis sp.																**69**
mimic shiner										23				3		**53**
northern pike	3							6	2		1		1		4	**17**
pumpkinseed	7		3	3	142		10	21	4	1	8	21	3	28	23	**428**
rock bass														4		**42**
round goby																**110**
smallmouth bass																**1**
spottail shiner																**9**
tadpole madtom															1	**1**
yellow perch		3	6	2		1	2	1	4	3	1		3	1	23	**146**
Total	**31**	**3**	**22**	**16**	**323**	**2**	**27**	**67**	**15**	**149**	**18**	**44**	**8**	**118**	**55**	**2143**

Appendix 6. Continued.

	Gear Type											
	Seine Net											
Site	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**Total**
Species												
Ameiurus sp.		2										**2**
banded killifish	5	1	2	7	14	24	24				3	**214**
black crappie			1									**1**
blackchin shiner	3		2	21		4	24		2			**337**
bluegill	3	3	2	17	1	32	10	1	21		9	**155**
bluntnose minnow	31	6	4	11	7	4	71		21			**188**
bowfin						1						**1**
brook silverside								1	39	114	9	**166**
brown bullhead												**1**
central mudminnow												**1**
Esox sp.												**1**
fathead minnow												**1**
golden shiner												**4**
Iowa darter	1			2								**12**
johnny darter					2		4				9	**16**
largemouth bass	30	3	22	13	66	1	14	1	8	2	6	**167**
Lepomis sp.		10	27	31							1	**69**
mimic shiner	25	1		1								**53**
northern pike												**17**
pumpkinseed	17	2	11	17	3	17	50		22		15	**428**
rock bass	1	2	18	2		7			4		4	**42**
round goby	6	3	1		11	13	5	6	8	2	55	**110**
smallmouth bass											1	**1**
spottail shiner	1	8										**9**
tadpole madtom												**1**
yellow perch	2		4	4	14	40	20		9	3		**146**
Total	**125**	**41**	**94**	**126**	**118**	**143**	**222**	**9**	**134**	**121**	**112**	**2143**

Appendix 7. Sampling gear and effort at 2005 Rondeau Bay sites.

Site	Field Number	Date	Duration (hours)	Description of Method
1	RDB05052505001a	25/05/2005	18	1.2 m fyke net, 6.35 mm mesh
2	RDB05052505002a	25/05/2005	18	1.2 m fyke net, 6.35 mm mesh
3	RDB05052505003a	25/05/2005	18	1.2 m fyke net, 6.35 mm mesh
4	RDB05052505004a	25/05/2005	18	1.2 m fyke net, 6.35 mm mesh
6	RDB05052605001a	26/05/2005	22	1.2 m fyke net, 6.35 mm mesh
7	RDB05052605002a	26/05/2005	22	1.2 m fyke net, 6.35 mm mesh
8	RDB05052605003a	26/05/2005	22	1.2 m fyke net, 6.35 mm mesh
9	RDB05052605004a	26/05/2005	22	1.2 m fyke net, 6.35 mm mesh
12	RDB05052705001a	27/05/2005	22	1.2 m fyke net, 6.35 mm mesh
13	RDB05052705002a	27/05/2005	22	1.2 m fyke net, 6.35 mm mesh
14	RDB05052705003a	27/05/2005	22	1.2 m fyke net, 6.35 mm mesh
15	RDB05052705004a	27/05/2005	22	1.2 m fyke net, 6.35 mm mesh
16	RDB05072605001	26/07/2005	21	1.2 m fyke net, 6.35 mm mesh
17	RDB05072605002	26/07/2005	21	1.2 m fyke net, 6.35 mm mesh
18	RDB05072605003	26/07/2005	21	1.2 m fyke net, 6.35 mm mesh
19	RDB05072605004	26/07/2005	21	1.2 m fyke net, 6.35 mm mesh
20	RDB05072705001	27/07/2005	20	1.2 m fyke net, 6.35 mm mesh
21	RDB05072705002	27/07/2005	20	1.2 m fyke net, 6.35 mm mesh
22	RDB05072705003	27/07/2005	20	1.2 m fyke net, 6.35 mm mesh
23	RDB05072705004	27/07/2005	20	1.2 m fyke net, 6.35 mm mesh
24	RDB05072805001	28/07/2005	22	1.2 m fyke net, 6.35 mm mesh
25	RDB05072805003	28/07/2005	22	1.2 m fyke net, 6.35 mm mesh
26	RDB05072805005	28/07/2005	22	1.2 m fyke net, 6.35 mm mesh
27	RDB05072805007	28/07/2005	22	1.2 m fyke net, 6.35 mm mesh

Appendix 7. Continued.

Site	Field Number	Date	Duration (Hauls)	Description of Method
1	RDB05052505001b	25/05/2005	3	9 m bag seine, 6.35 mm mesh
2	RDB05052505002b	25/05/2005	3	9 m bag seine, 6.35 mm mesh
3	RDB05052505003b	25/05/2005	3	9 m bag seine, 6.35 mm mesh
4	RDB05052505004b	25/05/2005	3	9 m bag seine, 6.35 mm mesh
5	RDB05052505005	25/05/2005	3	9 m bag seine, 6.35 mm mesh
6	RDB05052605001b	26/05/2005	3	9 m bag seine, 6.35 mm mesh
7	RDB05052605002b	26/05/2005	n/a	9 m bag seine, 6.35 mm mesh
8	RDB05052605003b	26/05/2005	3	9 m bag seine, 6.35 mm mesh
9	RDB05052605004b	26/05/2005	3	9 m bag seine, 6.35 mm mesh
10	RDB05052605005	26/05/2005	3	9 m bag seine, 6.35 mm mesh
11	RDB05052605006	26/05/2005	3	9 m bag seine, 6.35 mm mesh
12	RDB05052705001b	27/05/2005	2	9 m bag seine, 6.35 mm mesh
13	RDB05052705002b	27/05/2005	3	9 m bag seine, 6.35 mm mesh
14	RDB05052705003b	27/05/2005	3	9 m bag seine, 6.35 mm mesh
15	RDB05052705004b	27/05/2005	3	9 m bag seine, 6.35 mm mesh
24	RDB05072805002	28/07/2005	2	9 m bag seine, 6.35 mm mesh
25	RDB05072805004	28/07/2005	2	9 m bag seine, 6.35 mm mesh
26	RDB05072805006	28/07/2005	2	9 m bag seine, 6.35 mm mesh
27	RDB05072805008	28/07/2005	2	9 m bag seine, 6.35 mm mesh
28	RDB05170805001	17/08/2005	1	15 m boat seine
29	RDB05170805002	17/08/2005	1	15 m boat seine
30	RDB05170805003	17/08/2005	1	15 m boat seine
31	RDB05170805004	17/08/2005	1	15 m boat seine
32	RDB05170805005	17/08/2005	1	15 m boat seine
33	RDB05170805006	17/08/2005	1	15 m boat seine
34	RDB05170805007	17/08/2005	1	15 m boat seine

Appendix 8. Habitat data from Rondeau Bay sites, 2004.

Site	Date	Air Temp. (°C)	Water Temp. (°C)	Conductivity (µs)	Secchi Depth (m)	Distance From Shore (m)	Maximum Sampling Depth (m)	Aquatic Vegetation Type (%)*	Substrate Type (%)**
1	22/06/2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	22/06/2004	21.5	21.9	384	0.33	10	2	E (50)	ST (100)
3	22/06/2004	23.1	23.2	445	0.2	10	1	S(40)/E (20)	ST (100)
4	22/06/2004	21.3	22.1	463	0.2	10	1	S (50)	ST (100)
5	23/06/2004	23.1	22.2	384	0.4	25	1	S (70)	ST (100)
6	23/06/2004	20.6	21.1	448	0.3	50	1	S (70)	ST (100)
7	23/06/2004	19.2	21.5	333	0.9	50	1.5	S (80)	ST (100)
8	23/06/2004	20.8	22.4	294	0.9	10	0.9	S (60)	ST (60)/SD (40)
9	29/06/2004	26.7	22.2	359	0.4	10	1	S (40)	ST (70)/SD (30)
10	28/06/2004	24.4	21.9	262	1.4	100	1.4	S (100)	SD (50)/ST(50)
11	28/06/2004	18.8	20.5	287	0.85	1	0.85	E (50)/S(50)	SD (70)/ST(20)/D(10)
12	28/06/2004	19.3	20.9	289	0.8	1	0.8	E (100)	SD (40)/ST(40)/D(20)
13	29/06/2004	19.5	19.9	293	0.75	0.75	0.75	S (50)/E(50)	SD (50)/ST(25)/D(25)
14	29/06/2004	21.1	20.1	287	0.75	2	0.75	S (50)/E(50)	SD (50)/ST(25)/D(25)
15	29/06/2004	20.1	20.4	284	0.7	2	0.7	E (50)/S(50)	SD (50)ST(25)/D(25)
1	26/07/2004	18	19.95	n/a	> 0.5	n/a	n/a	n/a	n/a
	26/07/2004	18	19	n/a	> 0.5	n/a	n/a	n/a	n/a
2	26/07/2004	18	19	n/a	> 0.5	n/a	n/a	n/a	n/a
	26/07/2004	18	19	n/a	> 0.5	n/a	n/a	n/a	n/a
3	27/07/2004	19	19.91	n/a	0.5	n/a	n/a	n/a	n/a
	27/07/2004	19	19.91	n/a	0.5	n/a	n/a	n/a	n/a
4	27/07/2004	19	19.88	n/a	n/a	n/a	n/a	n/a	n/a
	27/07/2004	19	19.88	n/a	n/a	n/a	n/a	n/a	n/a
5	28/07/2004	16	19.11	n/a	>0.5	n/a	n/a	n/a	n/a
	28/07/2004	16	19.11	n/a	0.5	n/a	n/a	n/a	n/a
6	28/07/2004	16	19.16	n/a	> 0.5	n/a	n/a	n/a	n/a
	28/07/2004	16	19.16	n/a	0.5	n/a	n/a	n/a	n/a

*E – emergent; S – submergent

**SD – sand; ST – silt; D – detritus

Appendix 8. Continued.

Site	Date	Air Temp. (°C)	Water Temp. (°C)	Conductivity (µs)	Secchi Depth (m)	Distance From Shore (m)	Maximum Sampling Depth (m)	Aquatic Vegetation Type (%)	Substrate Type (%)
	29/07/2004	23	21.19	n/a	0.5	n/a	n/a	n/a	n/a
7	29/07/2004	23	21	n/a	0.5	n/a	n/a	n/a	n/a
	29/07/2004	24	21.29	n/a	0.5	n/a	n/a	n/a	n/a
8	29/07/2004	24	21.29	n/a	0.5	n/a	n/a	n/a	n/a
	04/08/2004	16	25.09	n/a	0.3	n/a	n/a	n/a	n/a
9	04/08/2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	04/08/2004	16	24.56	n/a	n/a	n/a	n/a	n/a	n/a
10	04/08/2004	16	24.56	n/a	n/a	n/a	n/a	n/a	n/a
	05/08/2004	17	20.44	n/a	0.5	n/a	n/a	n/a	n/a
11	05/08/2004	17	20.44	n/a	0.5	n/a	n/a	n/a	n/a
	05/08/2004	18	20.51	n/a	1	n/a	n/a	n/a	n/a
12	05/08/2004	18	20.51	n/a	1	n/a	n/a	n/a	n/a
	06/08/2004	19	18.8	n/a	1	n/a	n/a	n/a	n/a
13	06/08/2004	19	18.8	n/a	> 1	n/a	n/a	n/a	n/a
	06/08/2004	19	19.07	n/a	1.25	n/a	n/a	n/a	n/a
14	06/08/2004	19	19.07	n/a	1.25	n/a	n/a	n/a	n/a

Appendix 9. Habitat data from 2005 Rondeau Bay sites.

Site	Date	Air Temp. C)	Water Temp. (°C)	Conductivity (µs)	Secchi Depth (m)	Distance From Shore (m)	Maximum Sampling Depth (m)	Aquatic Vegetation Type (%)*	Substrate Type (%)**
1	25/05/2005	18.5	14.5	515	n/a	7	0.61	E (50)/S(10)	ST(100)
2	25/05/2005	17.7	14.5	457	1.1	7	0.509	E(50)/S(10)	ST(100)
3	25/05/2005	17.2	14.6	475	0.525	7	0.57	E(90)	ST(100)
4	25/05/2005	17.2	14.7	449	0.945	7	0.44	E(50)/S(15)	ST(100)
5	25/05/2005	19.5	22.4	407	0.65	10	0.4	E(90)	ST(100)
6	26/05/2005	17.4	17.6	459	1.06	7	0.61	E(60)/S(15)	ST(100)
7	26/05/2005	18.8	18.5	421	0.76	7	0.65	E(15)/S(15)	ST(100)
8	26/05/2005	16.7	19.9	438	0.9	n/a	0.55	E(50)/S(10)	ST(100)
9	26/05/2005	17.8	19.4	456	0.77	7	0.66	E(30)/S(20)	ST(100)
10	26/05/2005	19.7	22.6	389	0.685	10-20	0.32	S(10)	SD (70)/ST(30)
11	26/05/2005	15.4	21.3	437	0.76	10-20	0.42	E(10)/S(5)	SD (65)/ST(35)
12	27/05/2005	17.2	19.2	437	0.79	10-20	0.467	n/a	ST(100)
13	27/05/2005	18.6	23.6	417	0.76	10-20	0.34	n/a	ST(100)
14	27/05/2005	18.2	24.2	457	0.46	7	1.3	n/a	ST(100)
15	27/05/2005	21.2	23.8	364	0.41	10-20	0.32	E(50)/S(20)	ST(100)
16	26/07/2005	25.8	26.1	229	> 1.2	30	0.37	S(80)	ST(100)
17	26/07/2005	26.2	26.1	230	> 1.2	55	0.33	S(50)/E(30)	ST(100)
18	26/07/2005	25.8	26.2	254	> 1.2	51	0.35	S(85)	ST(100)
19	26/07/2005	25.8	26.1	229	> 1.2	60	0.37	S(70)/E(15)	ST(100)

*S – submergent; E – emergent

**ST – silt; SD – sand

Appendix 9. Continued.

Site	Date	Air Temp. (°C)	Water Temp. (°C)	Conductivity (µs)	Secchi Depth (m)	Distance From Shore (m)	Maximum Sampling Depth (m)	Aquatic Vegetation Type (%)*	Substrate Type (%)**
20	27/07/2005	n/a	21.3	239	> 1.2	0-10	1	S(70)/E(30)	D(100)
21	27/07/2005	n/a	21.3	327	n/a	0-10	1	S(70)/E(30)	D(100)
22	27/07/2005	n/a	21.7	235	0.51	0-10	n/a	S(90)	D(50)/ST(50)
23	27/07/2005	n/a	22.9	230	> 1.2	0-10	1.1	S(80)	ST(100)
24	28/07/2005	15.5	18.8	234	> 1.2	0-10	0.72	S(50)	SD(90)/ST(10)
25	28/07/2005	16.8	20.5	230	> 1.2	0-10	n/a	S(50)	D(60)/ST(40)
26	28/07/2005	17.9	21.6	233	> 1.2	0-10	0.72	S(60)	D(100)
27	28/07/2005	24.3	22.4	230	> 1.2	0-10	0.5	S(60)	SD(70)/ST(30)
28	17/08/2005	21.5	24.4	233	n/a	15	0.75	S(40)	SD(70)/G(20)/CO(5)/D(5)
29	17/08/2005	22.2	24.4	231	> 1.2	500	0.68	F(50)	SD(80)/ST(20)/
30	17/08/2005	24.5	25.8	232	> 1.2	500	1	S(90)/F(10)	SD(40)/D(40)/ST(20)
31	17/08/2005	28.7	26.4	229	> 1.2	n/a	n/a	n/a	SD(70)/G(20)/CO(10)
32	17/08/2005	26	26	256	> 1.2	5	0.82	S(40)/E(10)	SD(60)/G(30)/ST(10)
33	17/08/2005	25.6	28	228	> 1.2	350	0.93	S(5)	SD(90)/G(5)/ST(5)
34	17/08/2005	27.4	28.1	239	n/a	n/a	1.05	S(75)	SD(80)/ST(20)

*S – submergent; E – emergent; F – floating

**SD – sand; ST – silt; D – detritus; G – gravel; CO – cobble